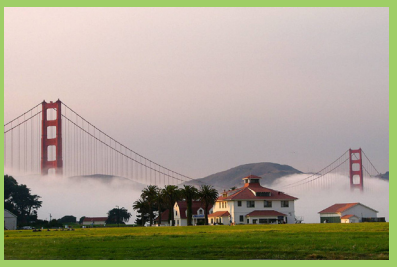
A Summary of the

Strategies for Greening Historic Properties Study



Department of Defense
Legacy Resource
Management Program

Project No. 09-452

A Short Guidebook for Greening Historic Properties

The "greening" of historic buildings is fast becoming a significant aspect of cultural resource management. This short guidebook is a companion document to a more comprehensive study entitled, "Strategies for Greening Historic Properties" (Legacy Project 09-452), which is designed to help Department of Defense (DoD) cultural resource specialists, planners, architects, designers, engineers, and others responsible for the preservation of historic buildings, structures, and landscapes to understand how sustainable, "green" features can be incorporated into historic building renovation projects without compromising the property's significant architectural characteristics. By offering some examples from case studies, it is hoped that this guidebook will assist the reader in understanding how green building techniques and sustainability methods have been incorporated into historic building rehabilitation projects. For more information on sustainability and "green" projects, and how they can be effective tools in rehabilitating historic buildings, refer to the document cited above.

Historic Preservation Rehabilitation Projects

Rehabilitating an historic building or landscape can be a tricky proposition, and may be further complicated by attempting to incorporate modern sustainability methods and green building techniques that are required by DoD policies in order to increase energy efficiency, while at the same time maintain a building's historic qualities. When planning a rehab project for a property that is considered eligible for inclusion in the National Register of Historic Places, you must determine beforehand whether or not the proposed alterations or modifications will adversely affect its significant architectural characteristics. This determination is made by consulting with your installation's cultural resource manager (CRM) and your State Historic Preservation Officer (SHPO). If your plans are determined to have "No Effect" on the building's historic characteristics, you can proceed with the project. If it is determined that there will be an effect, the CRM and SHPO will consult on whether or not the effect is "Adverse," that is, whether or not the project will permanently alter any significant architectural features.

Further consultation about avoiding or minimizing the potential adverse effect must be carried out well in advance of construction to ensure that all parties are satisfied that the effects of the project have been thoroughly considered before the any renovation plans are finalized.

Rehabilitation Projects and Sustainability: Case Studies

Since 2006 the various components of the DoD have relied on a memorandum of agreement to ensure that construction projects at DoD installations adhere to the five sustainability principles endorsed by the National Institute of Building Sciences (NIBS). These principles of sustainability, which are the basis for the recommendations offered in this guidebook, include:

- Employ Integrated Design Principles
- Optimize Energy Performance
- Protect and Conserve Water
- Enhance Indoor Environmental Quality
- Reduce Environment Impact of Materials

In addition, some DoD installations have used the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED) rating system as guidance for sustainable building projects.

This guidebook summarizes the eight case studies found in "Strategies for Greening Historic Properties" to illustrate how sustainability and green building techniques have been used in historic preservation rehabilitation projects. Even though not all are DoD buildings, they were chosen for their diversity of style and location, and for the availability of information on their projects. Each study briefly describes how sustainability principles were applied in the rehabilitation project and whether or not these practices affected the historic architectural characteristics of the buildings. It is hoped that the reader will come away with a better understanding of how sustainability and historic preservation can work hand-in-hand to promote energy conservation while at the same time preserving our historic built environment.

Washington Navy Yard, Building 33

A Sample Green Feature

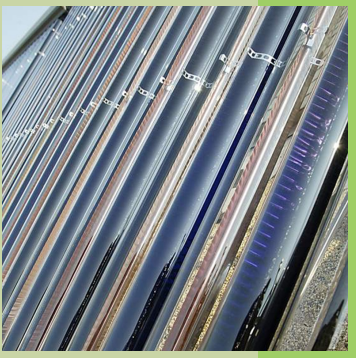
One of the approaches adopted for "greening" the Washington Navy Yard was the addition of structures and techniques used to reduce stormwater runoff that otherwise contributed to localized soil erosion and added pollutants to the Anacostia River watershed. Innovations such as permeable paving in parking areas, street tree filters, street sweeping to remove contaminants and sediments, and the diversion of roof rainwater into soil and rain barrels, contribute to a reduction of contaminants and promote bioretention, whereby contaminants in the water are removed by passing through media or through natural biological filters (plants) in rain gardens. Installation of these measures had little or no effect upon Building 33's historic architectural characteristics.

The Washington Navy Yard, comprised of nine blocks of 19th and early 20th century industrial and residential buildings, was one of the United States' first naval yards and was Washington's largest and most important manufacturing area in the 19th century. Building 33 was constructed during the 1850s as a 45-foot high open bay factory building. When the decision was made to rehabilitate the building, the Navy's architects used the earliest version of the LEED rating system for sustainable buildings for general guidance; however, they did not apply for formal LEED certification. The rehabilitation was a "pilot project" for the Navy facilities construction program, which previously had not attempted a comprehensive green rehabilitation on a major facility. Sustainability features and principles used included brownfield mitigation, access to public transportation, energy efficiency measures, lighting, water efficiency, envelope insulation, recycled materials, construction waste management, operations, and indoor environmental quality.

The Pentagon, Washington, D.C.

The Pentagon was built in 1943 to consolidate the widely scattered offices of the War Department (today the DoD) in the District of Columbia. Upon its completion it was the largest office building in the world, covering 29 acres and consisting of 17.5 miles of corridors. Built of reinforced concrete, it consists of five concentric five-story pentagons connected by radiating corridors, all centered on a six-acre interior courtyard. Working under

conditions of wartime building supply shortages, the Pentagon's builders substituted concrete ramps for passenger elevators and concrete drainpipes in place of metal drainpipes. At that time it was the largest office building in the world, covering 29 acres and consisting of 17.5 miles of corridors. As of 2010, Pentagon architects were attempting to achieve LEED certification with its Wedge renovations. Sustainable features and principles that have been incorporated into the Pentagon during its recent, ten-year renovation period have included public transportation, energy efficiency measures, lighting, water efficiency, envelope insulation, recycled materials, construction waste management, and indoor environmental quality.



A Sample Green Feature

During Pentagon rebuilding following the 9-11 attack, a solar energy farm was constructed that includes a 258,000/BTU/hour hot water system. The system supplements the hot water requirements for the rebuilt sections of the building. Solar collectors on the roof provide heated service water, in order to reduce the use of natural gas in the central boiler plant. The 1,080 solar collector tubes form a 75-kilowatt thermal system that heats water by transferring heat via a copper or aluminum fin that is attached to a metal pipe. Solar heat is thus transferred to the water circulating through the pipe. The placement of solar energy equipment on the Pentagon's roof did create a negative visual impact on the building's roofline; however, the new piping was concealed within the existing roof structure and is not visible.

The Presidio, San Francisco, California

A Sample Green Feature

To reduce the environmental impact of old building materials, the Presidio in San Francisco uses recycled building products whenever possible. At the Thoreau Center for Sustainability, these products include: sustainably harvested EcoPanels from Architectural Forest Enterprises, and maple veneers from the Menominee Tribe; formaldehyde-free medium density composite fiberboard panels manufactured from recycled wood; fiberboard panels made from 100% recycled wood; rest room tiles made with recycled windshield glass; nontoxic, water-based tile adhesives; linoleum flooring; and other recycled and sustainable products. All remodeling projects strived to maintain the buildings' historic characteristics.

The Presidio consists of nearly 500 historic buildings and several hundred acres of designed, vernacular, and natural landscapes. The complex has served as a military fort since its construction by the Spanish in 1776. In 1846, during the Mexican-American War, the Presidio was occupied by the United States Army and it remained a U.S. Army post until 1994, when the installation was decommissioned. It is now governed by a federal trust as part of the Golden Gate National Recreation Area. Many of its buildings and its landscapes have been restored employing both sustainability and historic preservation principles.

Within the Presidio, the Letterman complex, which includes the Thoreau Center for Sustainability, was the earliest major renovation, and its seven buildings were renovated using "green" guidelines devised by the Presidio Trust. When LEED became available in 1998, the Presidio adapted its own "Green Building Guidelines" as a Presidio-specific modification of LEED. Sustainability features and principles applied at the Presidio include proximity to public transportation, energy efficiency measures, lighting, water efficiency, envelope insulation, recycled materials, construction waste management, operations, and indoor environmental quality.

Building 7 (7 Storehouse Row), Charleston Navy Yard, Charleston, South Carolina

The Charleston Navy Yard served the United States Navy as a major shipbuilding and supply facility between 1903 and 1996, when the yard was leased to a private shipbuilding concern. During its active years as a Navy yard it produced nearly forty destroyers, including many that played an important role in the United States victory in World War II. The Charleston Navy Yard exemplifies the massive growth of shore-based operations that proliferated in the early twentieth century to support a growing U.S. Navy. Since the late 1990s, the Noisette Company has been refitting the former Charleston Navy Yard for residential and office occupancy using LEED 1.0 pilot principles.

Building Number 7 in the Navy Yard's historic district is a 1908 Warehouse Building constructed in the Neo-Classical style. It is one of 28 buildings erected during the initial building campaign at the shipyard. It became an Administration Building after the Navy began using large single-story warehouse buildings for storage purposes. The building was renovated using several sustainability principles, including access and proximity to public transportation, water and energy efficiency, lighting, envelope insulation, use of recycled materials, construction waste management, and indoor environmental quality.

A Sample Green Feature

Building 7 uses energy efficient approaches to its HVAC system. The system operates only in occupied interior spaces, and the heating and cooling of some spaces is accomplished with an efficient central chilled water system. In addition, open spaces are kept cool with large, twelve-foot diameter ceiling fans to provide constant airflow during summer months, while suspended radiant heaters are hung in key locations for special events during cooler months. All equipment is hidden on the building's exterior, minimizing visual impacts to the building's historic architectural character.

46 Blackstone South, Harvard University, Cambridge, Massachusetts

A Sample Green Feature

46 Blackstone South used commissioning, measurement, and verification techniques to help monitor energy use in the rehabilitation project. The building is metered to monitor energy use, while UOS simulates energy use of a baseline building and compares actual energy use data gathered with metering to calculate energy savings. Metering is used for lighting systems and controls, constant and variable motor loads, variable frequency drive operation, chiller efficiency at variable loads, cooling load, air distribution static pressures and ventilation air volumes, building-specific energy efficiency systems and equipment, and indoor water risers. Metering of operational systems usually has no effect on a building's historic features.

The 46 Blackstone South project includes three buildings consisting of a nineteenth century manufacturing building, and two buildings that were part of an early twentieth century electrical plant complex, built in various stages between 1889 and 1929. Today, the buildings serve as the Central Steam Plant for some 200 buildings at Harvard University, and they are the headquarters for University Operations Services (UOS). The renovation of the buildings achieved LEED Platinum certification for New Construction and Major Renovations in 2007. The project incorporates many sustainability principles including site water efficiency, heat island effect reduction, energy performance optimization, energy efficient HVAC, an energy efficient building envelope, water conservation measures, ventilation and thermal comfort measures, construction waste management, and recycled and biobased content.

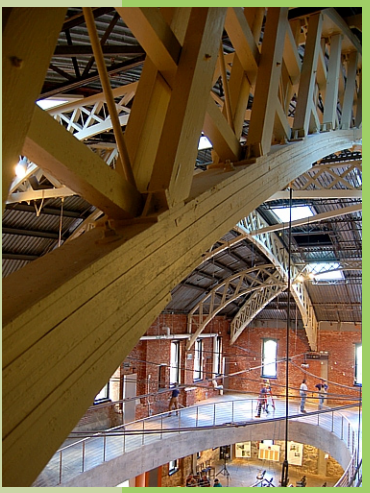
The Gerding Theater at the Armory (Annex), Portland, Oregon

The Portland National Guard Armory Annex was constructed in 1891, enlarging the original 1887 Armory building of the Oregon National Guard. A 2002-2006 renovation converted the building into a space for the Gerding Theater. The original armory building was torn down in 1968, but the Annex remained, and the Guard sold the building to a brewery in 1996. After the brewery closed, the building was sold to the Gerding/Eden Development Company, which renovated and converted the building into a 600-seat theatre space.

A Sample Green Feature

The Gerding Theater at the Armory used 42 skylights, 17 of which are operable in order to provide natural daylight into the interior as well as fresh air to improve indoor air quality. Since the roof's wood support trusses were the only part of the roof that was historically significant, penetrating the roof with skylights did not compromise the building's historic integrity.

The Armory Annex is a notable sustainable design showcase, having received a Platinum LEED Certification for Existing Buildings in 2007. Sustainable features incorporated into this rehabilitation project include brownfield redevelopment, alternative transportation, stormwater management, landscape and exterior design to reduce heat island effect, water efficient landscaping, interior water efficiency, water use reduction, optimization of energy performance, commissioning, purchased green power, daylighting, low-emitting materials, in addition to other sustainable features.



Cambridge City Hall Annex, Cambridge, Massachusetts

A Sample Green Feature

The Cambridge City Hall Annex has ready access to the city's public transportation system, as well as to car-pooling programs. In addition, a bicycle storage area and a shower/changing room for bike commuters is provided in the building. There were no negative impacts upon the historic character of the building as a result of employing these sustainable transportation initiatives.

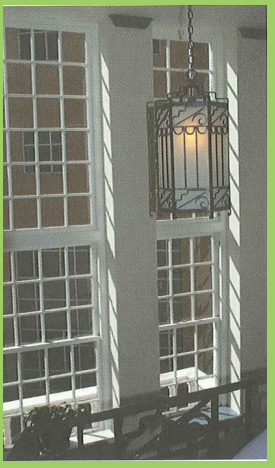
Cambridge City Hall Annex was originally constructed in 1871 as the Harvard Grammar School. As originally constructed, the building had a Mansard roof, which was destroyed during a fire in 1899. Following the fire, a new third floor was added, topped by a brick parapet. This feature was subsequently removed during a 1939 conversion of the building to municipal use. The discovery in 1999 of mold in the building led to its immediate closure, and remediation and renovation between 2000 and 2004 resulted in the restoration of the 1899 parapet and the addition of a usable, accessible two-story lobby entry in what had been the basement of the building. The building was certified LEED Gold under New Construction in 2004. It incorporates many "green" features and is regarded as an exemplary blend of historic preservation and sustainability. It includes water efficiency measures, alternative commuting options, recycled building materials, sustainable forestry products, carbon sensors and low-emitting volatile organic compounds, solar power, and daylight and occupancy sensors to reduce electricity demand through lighting. The building also maximizes daylighting wherever possible.

New Mexico Villagra Building, Santa Fe, New Mexico

The New Mexico Villagra Building was designed by prominent Southwest regional architect John Gaw Meem, the leading proponent in the early twentieth century of the Spanish-Pueblo Revival and Territorial Revival styles. Built in 1934 to house the state's public welfare department, it was designed with the distinctive brick coping and Classically-inspired pedimented window and door surrounds that characterize the Territorial Revival style.
The New Mexico Villagra Building, which is now occupied by the Office of the New Mexico Attorney General, achieved LEED Commercial Interiors Gold status in 2006. It employs many sustainability principles directly related to LEED, including designated preferred parking for low-emitting and fuel efficient vehicles, bicycle racks and showers to encourage alternative transportation, and access to public transportation. It also uses state-of-the-art lighting sensors that dim and brighten electric lights based on the amount of sunlight coming through windows, which provide light and views to 90 percent of the office space. It uses a high performance ventilation system to keep indoor air healthy. The building has an overall energy savings of 31 percent, and 82 percent of construction waste was recycled during renovation.

A Sample Green Feature

The New Mexico Villagra Building has optimized energy performance by installing R-30 insulation in the roof, adding two inch (R-14) insulation to the top floor ceiling interior; installing R-11 insulation to the interior surface of exterior concrete walls, which was then covered in gypsum board; and by enhancing the performance of the historic windows with ceramic film applications and making them operable as originally designed. These measures had no appreciable impact upon the building's historic character.



"Low Hanging Fruit"
Easily Implemented Green Solutions

Not every modification or upgrade described in the case studies involved a complicated design and construction project. Easily implemented green solutions – known as "low hanging fruit" – are within reach of small budgets, take little to install, and have immediate benefits. Here is a list of "Low Hanging Fruit" strategies:

- Use Energy Star-rated appliances to conserve energy.
- Conserve water use by installing low flush toilets, sensor-activated faucet sensors, faucet aerators, low-flow urinals; and remember to lower your hot water tank temperature.
- Reduce lighting costs by using task lighting rather than ambient fixtures; reduce overall ambient lighting from 50 to 35 foot-candles; use high efficiency fluorescent T-8 lamps; install occupancy sensors to turn off lights.
- Meter and inspect operational systems regularly.
- Use environmentally friendly cleaning products, such as low VOC and non-toxic cleaning supplies to improve indoor air quality.
- Use "walk-off mats" to reduce contaminants and improve indoor air quality.
- Employ low-impact integrated pest management methods to avoid adverse environmental effects.
- Encourage use of public transportation; construct bicycle racks; and have parking spaces reserved for fuel-efficient vehicles.
- Strive to keep long-term tenants to reduce effects of refurbishing and remodeling a building and thus generating construction waste.

And don't forget to perform routine maintenance to prevent larger, more costly repairs in the future!

VAN CITTERS HISTORIC PRESERVATION

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Photo sources are noted in technical report 09-452, August 2010